Waterfowl Species Richness

These EnviroAtlas national maps display the number of waterfowl species based on potential habitat within each 12-digit hydrologic unit (HUC) in the conterminous United States. These data are based on habitat models rather than wildlife counts. Potential habitat may be specific to wintering, breeding, or year-round activities depending on the species.

Why are waterfowl species important?

Waterfowl are defined as a group of swimming birds from the Family Anatidae, including ducks, geese, and swans. The metric, Waterfowl Species Richness, estimates the number of waterfowl species that may inhabit an area based on their range and potential habitat.

Species richness is one measure of biodiversity that can represent the relative conservation value of a particular area. Many scientists believe that biodiversity, because it represents all forms of life on earth, provides or supports the core benefits that humans derive from their environment to sustain human society, economy, health, and well-being. Managing for biodiversity is one way to balance competing demands for ecosystem services.[1]

Each species plays an important role in its ecosystem. Within a food chain, waterfowl serve as a food source for other wildlife and function as primary and secondary consumers, with various species feeding on plant material, invertebrates, fish, and aquatic and terrestrial insects. Waterfowl disperse aquatic and terrestrial plant seeds, which can influence the distribution of (both native and non-native) plant species locally or over longer distances.[2]

Waterfowl also influence ecosystems by moving nutrients between wetland and terrestrial habitats. Studies have shown that waterfowl can deposit 40% of the nitrogen and 75% of the phosphorus entering a wetland.[2] Nutrients deposited in waterbodies by waterfowl accumulate mostly during wintering, when bird densities increase over smaller areas. According to Ducks Unlimited, two-thirds of North America's waterfowl winter in the southern states, meaning that maintaining quality waterfowl habitat in the southern states is critical to the health of the North American population.

In addition to the important roles that waterfowl play in our ecosystems, they are also a popular food source. Waterfowl hunting has a long tradition in the U.S. A recent national


Photo: George Gentry/USFWS

survey found that ducks were the most sought after group of migratory birds hunted in the U.S. In 2011, hunters spent 23 million days hunting birds such as waterfowl and other game birds, which generated $1.8 billion for the U.S. economy.[3] Waterfowl are also appreciated by wildlife-watchers for their aesthetic beauty and the recreational opportunities they provide. There are an estimated 46.7 million birdwatchers in the U.S. and waterfowl are the most highly-viewed group of birds. In total, wildlife viewing contributed almost $55 billion to the U.S. economy in 2011.[3]

How can I use this information?

Three EnviroAtlas maps, Mean, Maximum, and Normalized Index of Biodiversity (NIB), illustrate Waterfowl Species Richness within each 12-digit HUC across the conterminous United States.[4] Used together or independently, these maps can help identify areas of potentially low or high waterfowl species richness to help inform decisions about resource restoration, use, and conservation. Mean richness is a commonly used and understood value for comparison. NIB provides an index to compare a metric with other metrics across multiple project scales simultaneously. Maximum richness identifies areas that are species rich but may not occupy large areas (e.g. linear riparian areas).

These maps can be used in conjunction with other EnviroAtlas maps such as ecoregions, the U.S. Geological Survey (USGS) protected areas database (PAD-US), or the USGS Gap Analysis Project (GAP) ecological systems to identify areas with high ecological or recreational value for conservation, recreation, or restoration planning. After learning the

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waterfowl species richness values for a particular 12-digit HUC, users can investigate an area more intensively by using individual species models available from the GAP Project.

How were the data for this map created?

The USGS GAP project maps the distribution of natural vegetation communities and potential habitat for individual terrestrial vertebrate species. These models use environmental variables (e.g., land cover, elevation, and distance to water) to predict habitat for each species. GAP modeled habitat for waterfowl species that reside, breed, or use the habitat within the conterminous U.S. for a significant portion of their life history. This map is based on a subset of GAP species identified as waterfowl species.

The list is derived from 47 GAP-modeled bird species identified as waterfowl species by state wildlife agencies combined to calculate richness by pixel. The mean and maximum numbers of waterfowl species in each 30-meter pixel were calculated for each 12-digit HUC. The mean species richness value by HUC was divided by the maximum mean value within all HUCs to calculate the NIB.

What are the limitations of these data?

EnviroAtlas uses the best data available, but there are still limitations associated with the data. These data, based on models and large national geospatial databases, are estimations of reality that may overestimate actual waterfowl species presence. Modeled data are intended to complement rather than replace monitoring data. Habitat models do not predict the actual occurrence of species, but rather their potential occurrence based on their known associations with certain habitat types. Habitat is only one factor that determines the actual presence of a species. Other factors include habitat quality, predators, prey, competing species, and fine-scale habitat features. Other essential species information in addition to species richness includes the types of species and their functional groups, whether they are rare or common, native or non-native, tolerant or intolerant of disturbance.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. Individual 30-meter pixel data may be downloaded from the New Mexico State University Center for Applied Spatial Ecology.

Where can I get more information?

A selection of resources related to waterfowl species and biodiversity is listed below. Information on the models and data used in the USGS Core Science Analytics, Synthesis & Library's GAP project is available on their website. For additional information on how the data were created, access the metadata for the data layer from the layer list drop down menu. To ask specific questions about this data layer, please contact the EnviroAtlas Team.

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Selected Publications

1. Boykin, K.G., W.G. Kepner, D.F. Bradford, R.K. Guy, D.A. Kopp, A. Leimer, E. Samson, F. East, A. Neale, and K. Gergely. 2013. A national approach for mapping and quantifying habitat-based biodiversity metrics across multiple spatial scales. *Ecological Indicators* 33:139–147.

2. Sekercioglu, C.H. 2006. Increasing awareness of avian ecological function. *Trends in Ecology and Evolution* 21(8):464–471.

3. U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. 2013. 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, FHW/11-NAT (RV), Washington, D.C.

4. Kepner, W.G., K.G. Boykin, D.F. Bradford, A.C. Neale, A.K. Leimer, and K.J. Gergely. 2011. Biodiversity metrics fact sheet. U.S. Environmental Protection Agency, Washington, DC, EPA/600/F-11/006.

Pearce, D., and D. Moran. 1994. *The economic value of biodiversity*. International Union for Conservation of Nature, Taylor and Francis, New York, New York. 104 p.